

REMARKS

Claims 1-17 have been canceled, and claims 18-45 added. The added claims cover subject matter previously disclosed in the text of the present application as originally filed. Five sheets of drawings have been revised in only minor respects. Two sections of the application have been amended, namely, the CROSS-REFERENCE TO RELATED APPLICATIONS section and the BRIEF DESCRIPTION OF THE DRAWINGS section. Five other paragraphs have also been amended in minor respects. No new matter has been added to the present application by virtue of this *Preliminary Amendment*. Procedurally, all of the amendments made herein comport with the requirements of 37 C.F.R. §1.121.

Applicants submit that the application is in condition for allowance. Formal drawing sheets will be submitted upon allowance of the application, unless the Examiner requires them sooner.

I. Drawings

A. Figure 1A

Applicants respectfully request that the proposed drawing sheet on which Figure 1A appears be accepted as a substitute for the sheet of like designation filed with the original application. In the originally filed version, the capacitor designated by numeral 26(d) should have been designated by 26(a). The proposed corrected sheet corrects this error, as is shown by the revisions marked in red.

B. Figures "1B"

The three sheets on which Figures 1B(1), 1B(2), and 1B(3) appear are submitted as substitutes for the sheets on which illustrations of the same subject matter were filed with the original application. Specifically, the application as originally filed was inadvertently submitted with three figures having the same label, i.e., "FIGURE 1B." Be advised that each of these figures constitutes only a partial view of a circuit schematic for a tapered birdcage coil; and collectively they illustrate the entire circuit schematic. Consequently, instead of using "FIGURE 1B" to label each of the three different partial views as was done on the originally filed sheets, the new sheets label these three figures "FIGURE 1B(1)," "FIGURE 1B(2)," and "FIGURE 1B(3)," respectively.

C. Figure "8"

Applicants request that the proposed drawing sheet submitted herewith on which appears Figures 8A and 8B be accepted as a substitute for the sheet on which illustrations of the same subject matter was filed with the original application. Specifically, one sheet bearing the label "FIGURE 8" was filed with the original application. That sheet, however, actually has two illustrations (i.e., top and side views) of a tapered birdcage coil. Consequently, instead of using "FIGURE 8" as the identifying label for both of those views, the new sheet identifies these two views as "FIGURE 8A" and "FIGURE 8B," respectively. This proposed change

makes the labels comport with the rest of the specification, as the top and side views are referred to as Figure 8A and Figure 8B, respectively, in the text of the application as filed.

Approval of the proposed informal drawing sheets is therefore requested. The revisions appear in red on the proposed informal drawing sheets, pursuant to 37 C.F.R. §1.121(d). Formal drawing sheets incorporating the proposed changes will be submitted upon allowance of the present application.

II. Specification

Two sections of the application have been amended. Specifically, the CROSS-REFERENCE TO RELATED APPLICATIONS section has been revised to identify those prior applications that are related to the present application. The BRIEF DESCRIPTION OF THE DRAWINGS section was amended only in minor respects, namely, to correct typographical and grammatical errors and to improve clarity. Five other paragraphs have also been amended for the same reasons.

Approval of the proposed revisions to the specification is therefore respectfully requested.

III. New Claims 18-45 Based On Subject Matter Previously Disclosed in Present and Parent Applications

Applicants respectfully submit that the claims in this Preliminary Amendment add no new matter to the present application. The revisions made herein have support in both the present application and the parent application on which it is based.

Because MPEP §2163.06 and MPEP §2163.07 are dispositive on this issue, Applicants quote the relevant sections thereof as follows:

MPEP § 2163.06 Relationship of Written Description Requirement
To New Matter

* * * If an applicant amends ... the abstract, specification or drawings of an application, an issue of new matter will arise if the content of the amendment is not described in the application as filed. Stated another way, *information contained in any one of the specification, claims or drawings of the application as filed may be added to any other part of the application without introducing new matter.* (emphasis added)

MPEP §2163.07 Amendments to Application Which Are Supported in
the Original Description

Amendments to an application which are supported in the original description are NOT new matter. (emphasis in original)

Applicants respectfully point out that the subject matter recited in new claims 18-45 was described in the present application as originally filed. Specifically, support for the coil(s) claimed in claims 18-36 and 45 can be found in the original text between pages 10 and 24 (and also in Figures 1A, 1B(1), 1B(2) 1B(3), 2B, 4, 6, 7A, 7B, 7C, 8A, 8B and 9). Similarly, support for the method of designing a coil that is claimed in claims 37-44 can be found on page 13, line 20, through page 14, line 20.

Applicants also point out that the same subject matter was also described in the parent application, i.e., U.S. Application 09/449,256, filed November 24, 1999, now U.S. Patent 6,344,745, granted February 5, 2002. The claimed subject matter also has support in the provisional application on which both the present and parent applications are based, namely, U.S. Provisional Application Serial No. 60/109,831, November 25, 1998.

Based on the foregoing, Applicants respectfully request examination of new claims 18-45.

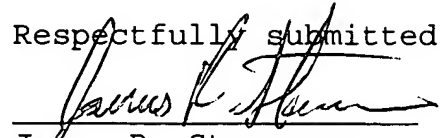
CONCLUSION

In this *Preliminary Amendment*, the CROSS-REFERENCE TO RELATED APPLICATIONS section and the BRIEF DESCRIPTION OF THE DRAWINGS section have been amended. Five other paragraphs have also been amended. In addition, five revised informal drawing sheets are submitted herewith.

The application as originally filed contained seventeen claims: three independent claims and fourteen dependent claims. Original claims 1-17 have been canceled, and claims 18-45 have been added. Consequently, upon entry of this *Preliminary Amendment*, the application will contain twenty-eight (28) claims: four (4) independent claims and twenty-four (24) dependent claims. These amendments do not add new matter to the application.

If the Examiner has any questions regarding this *Preliminary Amendment*, he is invited to call the undersigned at the telephone number listed below.

Respectfully submitted,


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APPENDIX 1

MARKED-UP COPY OF REVISED PARAGRAPHS OF APPLICATION

(Provided pursuant to 37 C.F.R. §1.121(b)(1)(iii))

PAGES 14-15: Replace the paragraph that spans pages 14 and 15 with the amended paragraph that appears below.

Figures 1A and 1B(1)-(3) are electrical schematics for two embodiments of a tapered birdcage resonator in accordance with the present invention. The tapered birdcage resonator embodiment shown in Figures 1B(1)-(3) is a "receive only" resonator, i.e., the tapered birdcage resonator does not apply the excitation pulses, but rather the coil is used with an external transmit coil. The coil shown in Figures 1B(1)-(3) includes decoupling networks to actively decouple the coil during transmit cycles, which technique is well known to those skilled in the art. As described further below, however, the tapered birdcage resonator may alternatively be a transmit/receive coil, as shown in Figure 1A.

PAGE 15: Replace the second full paragraph on page 15 with the amended paragraph that appears below.

Referring now to Figures 1A and 1B(1)-(3) for the band pass configuration, the capacitors on the small end ring 20 CS 22(a)-22(d) are selected to achieve proper impedance match using a balanced drive technique over 180 degrees of the end ring 20 for each of the two quadrature modes. The drive points are at virtual ground by splitting the end ring capacitors CS 22(a)-22(d) into two equal values CS' 24(a)-24(h) that are double the value of a single end ring capacitor CS 22(a)-22(d). In a preferred embodiment as shown in Figures 1B(1)-(3), the value of CS 22(a)-22(d) is 110 pF and therefore the value of CS' 24(a)-24(h) is 220 pF. Capacitance is distributed in the legs 30, CT 32(a)-32(h) and CL 34(a)-34(h), to minimize any electric field patient coupling to the coil.

PAGES 15-16: Replace the paragraph that spans pages 15 and 16 with the amended paragraph that appears below.

For the embodiment shown in Figures 1B(1)-(3), a total desired adjustable range of capacitance in the legs 30 is 34 pF to [51] 49 pF. Therefore, if CL 34(a)-34(h) is 33 pF then the

range of the trim capacitor CT 32(a)-32(h) in parallel with CL 34(a)-34(h) would be 1 pF to 16 pF, as shown in FIG. 1B. Tuning of the coil is achieved by varying the capacitance in the legs CT 32(a)-32(h) of the tapered resonator equally. The capacitors of the large end ring CLE 42(a)-42(h) are selected to minimize the electric field patient coupling to the coil. In a preferred embodiment, the value of CLE 42(a)-42(h) is 89 pF. Because the embodiment shown in Figures 1B(1)-(3) is a receive-only coil, the diodes D1 and D2 and inductors provide transmit decoupling.

PAGE 17: Replace the first full paragraph on page 17 with the amended paragraph that appears below.

Figures 1A and 1B(1)-(3) show electrical schematics for implementing the wire model of Figure 2B. Figures 7A through 7C show the structural characteristics, including a radius of an arc used for the legs, of a preferred embodiment of a tapered birdcage resonator.

PAGE 19: Replace the last full paragraph on page 18 with the amended paragraph that appears below.

Figures 8A and 8B [shows] show a tapered birdcage resonator in accordance with the fifth embodiment. Figure 8A, which is a view along the z-axis of the coil, shows the conductor geometry pattern in the XY imaging plane. In the XY imaging plane, the resonator has an elliptical shape, with the major diameter of the large end ring being 10.07 inches and the minor diameter of the large end ring being 9.27 inches. The small end ring has a major diameter of 5.875 inches and a minor diameter of 5.086 inches. As shown in Figure 8B, the radius of the taper towards the small end ring is 4.635 inches, and the radius begins 3.875 inches from the large end ring.



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APPENDIX II

MARKED-UP COPY OF REVISED SECTIONS OF APPLICATION

(Provided pursuant to 37 C.F.R. §1.121(b)(2)(iii))

CROSS-REFERENCE TO RELATED APPLICATIONS

The invention disclosed in this document is closely related to the following application for patent: *TAPERED BIRDCAGE RESONATOR FOR IMPROVED HOMOGENEITY IN MRI*, U.S. Application Serial No. 09/449,256, filed November 24, 1999, which issued as U.S. Patent 6,344,745 on February 5, 2002. The [This] present application, and the above-identified application on which it is based, claims the benefit of U.S. Provisional Application No. 60/109,831, filed November 25 1998.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments of the present invention are illustrated by way of example, and not limitation, in the figures of the accompanying drawings, in which:

Figure 1A depicts an electrical schematic of an embodiment of the present invention for an optimized transmit/receive tapered birdcage resonator;

Figures 1B(1), 1B(2) and 1B(3) [is] illustrate an electrical schematic of an [second] embodiment [of] for a receive-only tapered birdcage resonator;

Figure 2A depicts a wire model for a prior art birdcage resonator, where the wire model may be used in a Biot-Savart software analysis program, in which the conductor geometry pattern represents the case of a dome resonator, where the conductors at the most superior end of the coil converge to a common point;

Figure 2B depicts a wire model of a tapered birdcage resonator used in the Biot-Savart software analysis for the conductor geometry pattern of a novel tapered birdcage resonator, where the most superior end of the coil is dimensionally tapered to optimize the field pattern homogeneity in the XZ and YZ image planes, without sacrificing signal-to-noise performance;

Figure 2C depicts a wire model for a prior art birdcage resonator, where the wire model may be used in the Biot-Savart software analysis for the conductor geometry pattern of a standard cylindrically shaped birdcage resonator;

Figure 3 illustrates a cross sectional plot of the iso-intensity lines of the magnetic flux density (dB) as a function of position with respect to the conductor geometry pattern for the case of a dome resonator as shown in [figure] Figure 2A;

Figure 4 illustrates a cross sectional plot of the iso-intensity lines of the magnetic flux density (dB) as a function of position with respect to the conductor geometry pattern of the tapered birdcage resonator illustrated in Figure 2B, where the most superior end of the coil is dimensionally tapered to optimize the field pattern homogeneity in the XZ and YZ image planes, without sacrificing signal-to-noise performance;

Figure 5 illustrates a cross sectional plot of the iso-intensity lines of the magnetic flux density (dB) as a function of position with respect to the conductor pattern geometry of the standard cylindrically shaped birdcage resonator illustrated in Figure 2C;

Figure 6 depicts a wire model of a conductor pattern geometry for a tapered birdcage resonator in which both the superior and inferior ends of the coil are critically tapered;

Figures 7A through 7C show the structural characteristics, including a radius of the arc used for the legs, of a preferred embodiment of a tapered birdcage resonator;

Figures 8A and 8B illustrate an alternative embodiment of a high resolution tapered brain coil having an elliptical shape where the length of the coil is less than the large diameter of the large end ring and the legs are radially tapered; and

Figure 9 is an electrical schematic for the alternative embodiment of the tapered resonator shown in Figures 8A and 8B.